REMARKS

Claims 1-29 are in this application.

Applicants hereby affirm the provisional election of Species A (Self-assembled monolayer is prepared by a stamp) for further prosecution that was made by the undersigned in a telephone conversation with the Examiner on October 19, 2005. Accordingly, Applicants agree that the claims directed to non-elected species, Species B (Self-assembled monolayer is prepared by exposing the self-assembled monolayer to radiation with a mask), namely claims 14-21, would be withdrawn from prosecution.

The Office Action dated October 19, 2005 states that claims 1-4 are generic to Species A and Species B. Applicants agree that claims 1-4 are generic. However, Applicants respectfully point out that claims 22-29 are directed to the thin film in claim 1 being deposited by a solution-based deposition process. Thus, they are applicable to Species A and Species B.

Accordingly, claims 22-29, which depend directly or indirectly from claim 1, are also generic and, as such, they should also be examined along with claims 1-4, in as much as they relate to Species A.

Claims 14-29 have been provisionally withdrawn by the Examiner for being directed to the non-elected species (Species B). In view of the above analysis, Applicants respectfully request that only claims 14-21 be withdrawn from prosecution because they are directed to the non-elected species B and proceed with examination

of generic claims 1-4 and 22-29 along with claims 5-13, which are the claims directed to the elected Species A.

Claim 1 defines the method of the invention as follows:

> 1. A method of forming a patterned thin film, wherein said thin film is not a monolayer, said process comprising the step of:
> depositing a thin film material on a surface of a substrate having thereon a patterned underlayer of a self-assembled monolayer.

The term "monolayer" has a well-defined meaning in the art, which defines a "monolayer" as being a single layer of atoms and/or molecules. Accordingly, the thickness of a "monolayer" cannot exceed the molecular dimensions of the constituent atoms and/or molecules.

In contrast, "thin film" has plurality of layers of molecules and/or atoms, which collectively form a "thin film."

The present specification, the present application defines "thin film" as being:

(1) other than a monolayer, i.e., a thin film comprising a plurality of layers of molecules and/or atoms, which collectively form a "thin film;" and

(2) a film having a thickness of from at least about 5 nm to up to about 1000 nm, preferably from at least about 10 nm to up to about 300 nm, and most preferably from at least about 25 nm to up to about 100 nm.

The thin films deposited by the method of the present invention are not monolayers, which is clearly seen in EXAMPLE 5, on page 30, lines 1-7, of the specification, which states:

> "The chemically differentiated substrate surface was used to define the pattern of a thin film of 50 nm silica particles deposited from a colloidal suspension (Highlink OG 113-53), produced by Clariant Corp, which incorporates isopropanol and hexamethylene diacrylate as spin-casting solvents."

Page 30, line 3, of the specification clearly refers to "a thin film of 50 nm". Thus, it is clearly understood by a person of ordinary skill in the art that **a film of 50 nm** silica particles deposited from a colloidal suspension **is not a monolayer**.

Further, the thin film in the present invention is a material, for example, a polymer, a hybrid material, etc., **which does not require a chemical reaction with the substrate surface to form a thin film**.

Thus, **there is no chemical bond formed between the thin film and the substrate**. The thin film in the present example is physically adsorbed, not chemically bound to the substrate (see, for example, EXAMPLE 5).

In contrast, a SAM, as described in the known methods of the prior art, requires a head group that chemically binds to the substrate surface to form a monolayer, which is chemically bound to the substrate to form a single material or chemical entity. In the example of hexadecanethiol, the thiol functionality forms a chemical bond with the substrate, such as, gold.

The SAM and thin film differ in the following respects. A SAM is a self-assembled monolayer. A monolayer is **one molecular layer**. It has special definition in the art. It requires a head group that chemically binds to the substrate surface. The present invention employs SAM's to pattern thin films that are **more than one molecular layer** of material and do not require chemical binding to the substrate surface. Claim 1 defines the thin films to clearly exclude such monolayers.

The methods known in the prior art, such as that described by Kumar, form a patterned thin film comprising the steps of:

(1) providing a substrate having a patterned layer of a self-assembled monolayer (SAM) thereon; and

(2) depositing **a second self-assembled monolayer (SAM)** there over.

In contrast to the methods of the prior art, instant claim 1 defines a method in which **a thin film, which is not a monolayer,** is deposited on a surface of a substrate having thereon a patterned underlayer of a self-assembled monolayer. Instead, the thin film is clearly described to be a thin film of "an organic molecule, a short-chain organic oligomer, a long-chain organic polymer, a photoresist, an organic-inorganic hybrid material, a metallo-organic complex, a nanoparticle of metal, a nanoparticle of metal oxide, a nanoparticle of semiconductor, a silica particle, an inorganic salt, and a mixture thereof." (see claim 1).

The specification on page 18, line 11-15 states:

The organic underlayer acts to chemically differentiate the substrate surface, for example providing hydrophobic versus hydrophilic regions, affecting the wettability and deposition of the solution deposited thin film.

The specification on page 19, line 4-18 states:

The tail groups in the patterned organic underlayer differentiate the patterned and unpatterned regions of the substrate. Upon spinning or removing the substrate from the dipping solution, a continuous or discontinuous thin film, patterned in the geometry of the self-assembled monolayer or its inverse, as the case may be, depending on the chemical nature of the self-assembled monolayer and the thin film material, is deposited.

According to the present invention, large areas can be patterned in parallel, without the need for further post-deposition processing and thus, eliminating potentially damaging additional processing steps.

The specification on page 24, line 11-27 states:

Referring to Fig. 2C, it is seen that local photochemistry, defined by the pattern of the mask 38, has modified the self-assembled molecular monolayer in regions 42 shown in Fig. 2B to produce the chemically distinct surface 44. The chemically differentiated surface 44 is in contrast to the chemical nature of the original molecular monolayer 40, which now has a discontinuous pattern.

The self-assembled molecular monolayers, deposited and defined by the examples of microcontact printing and self-assembly/irradiative patterning, provide chemical differentiation between patterned and unpatterned regions of the substrate surface that affect the wettability and therefore the subsequent deposition thereon, by solution based techniques, of patterned thin film materials.

Thus, the deposited thin layer in the claimed invention becomes patterned during the deposition on the surface on which the thin film is being deposited because the surface is a chemically differentiated surface.

Accordingly, the claimed method **does not require an additional patterning step of the deposited thin film.**

None of the cited references, taken alone or in combination, has this feature. Accordingly, the method of claim 1 is neither taught nor suggested by the cited references.

(1) Rejection of claims 1-4 under 35 USC 102(b) as being anticipated by De Guire:

Claim 1 of De Guire reads:

> 1. A method for synthesizing a metal oxide thin film, comprising the steps of:
> providing a substrate;
> covalently bonding a self-assembled monolayer to a surface of the substrate, the self-assembled monolayer including a plurality of terminating moieties which provide bonding sites for metal oxides; and
> bonding metal oxide on the terminating moieties.

De Guire requires "including a plurality of terminating moieties which provide bonding sites for metal oxides" and further, it requires the step of "bonding metal oxide on the terminating moieties."

Claim 1 of the instant application does not have these features. The self-assembled monolayer (SAM) does not include a plurality of terminating moieties to provide bonding sites for metal oxides nor does it have the step of bonding metal oxide on the terminating moieties.

There is no covalent bonding between the SAM and the deposited thin film in the instant claims.

Chemical differentiation on the surface on which the thin layer is being deposited is the driving force to form a patterned deposited layer, i.e., the thin film.

As a result, the instantly claimed method is not the same as that described by De Guire. Therefore the rejection of claims 1-4 under 35 USC 102(b) as being anticipated should be withdrawn.

(2) Rejection of claims 5-11 under 35 USC 103(a) as being obvious over De Guire in view of Kumar:

As mentioned above, De Guire requires "including a plurality of terminating moieties which provide bonding sites for metal oxides" and further, it requires the step of "bonding metal oxide on the terminating moieties."

Kumar requires forming a patterned thin film having the steps of providing a substrate having thereon a **first** patterned layer of a self-assembled monolayer (SAM); and depositing a **second** self-assembled monolayer (SAM) there over.

Depositing a **second self-assembled monolayer** (SAM) over a **first self-assembled monolayer** (SAM) is a feature that is not present in instant claim 1. Claim 1 defines that **the thin film deposited by the method of the present invention is not a monolayer**.

The present invention merely employs SAM's to pattern thin films deposited thereon that are more than one molecular layer of material and **do not require covalent bonding to the surface on which it is being deposited**.

There is no teaching or suggestion in either Kumar or De Guire to modify the other reference in such a manner to produce the instantly claimed invention. Neither reference is capable of producing a deposited thin layer which becomes patterned during the deposition on a chemically differentiated surface such that **no additional patterning step of the thin film would be required.**

Accordingly, combining De Guire with Kumar is still deficient because the combination does not show all the elements of the claimed invention.

(3) Rejection of claims 12 under 35 USC 103(a) as being obvious over De Guire in view of Kumar and further in view of Chrisey:

The added reference of Chrisey does not cure the deficiency of the De Guire and Kumar combination because Chrisey does not address it.

There is no teaching or suggestion Chrisey to modify the other references in such a manner as to produce the instantly claimed invention. Chirsey does no teach or suggest how to produce a deposited thin layer which becomes patterned during the

deposition on a chemically differentiated surface such that **no additional patterning step of the thin film is required**. This aspect of the claimed invention is a feature that is described nowhere but in the instant application.

Accordingly, combining De Guire with Kumar and Chrisey is still deficient because the combination does not show all the elements of the claimed invention.

(4) Rejection of claims 12 under 35 USC 103(a) as being obvious over De Guire in view of Kumar and further in view of Chrisey Wefers:

As was the case with Chrisey, the added reference of Wefers does not cure the deficiency of the De Guire and Kumar combination because Wefers does not address it.

There is no teaching or suggestion Wefers to modify the other references in such a manner as to produce the instantly claimed invention. Wefers does no teach or suggest how to produce a deposited thin layer which becomes patterned during the deposition on a chemically differentiated surface such that **no additional patterning step of the thin film is required**. This aspect of the claimed invention is a feature that is described nowhere but in the instant application.

Accordingly, combining De Guire with Kumar and Wefers is still deficient because the combination does not show all the elements of the claimed invention.

In view of the foregoing, the rejections of the pending claims under 35 USC 102(b) and 35 USC 103(a) should be withdrawn and the rejected claims should be allowed.

In addition, Applicant respectfully points out that upon finding that the generic claims and claims directed to the elected species are free of prior art, Applicant would be entitled to either election of additional species or allowance of claims 1-29.

Accordingly, Applicants respectfully requests Reconsideration and allowance of the pending claims.

Respectfully submitted,

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